Name _____

Part A. Surface Area – Volume Ratios in Biological Systems

Surface Area (SA) can be thought of as the amount of area available as an "exit" or "entrance" for materials. **Volume increases much more rapidly than SA**. As a given cell/organism increases in volume, it increases the amounts of nutrients required to be brought in and wastes needing to be expelled…but surface area does not change as quickly. Import/export rate of exchange depends on the SA-V ratio. The higher the ratio, the faster the rate of exchange is. Consider the following example:

A palm leaf has no infoldings, but a maple leaf has numerous infoldings

Let's imagine that both leaves have the same volume, **$50cm^3$**

Now, consider the SA… The palm has a SA of **$100cm^2$** while the maple has a SA of **$1000cm^2$**.

1. Calculate the SA-V ratio for each leaf (SA ÷ V)

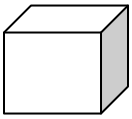
Palm _____ Maple _____

2. Which leaf will lose heat faster and why?

3. Which plant will have to use more energy to move materials in and out and why?

For the cube-shaped cells to the right:

s = 5mm



s = 10mm

4. Which will lose heat faster and why? (SA of a cube = area of one face x 6)

5. Which will have to use more energy to move materials in and out and why?

6. Explain why it is more logical for large organisms to be made of many small cells versus just one gigantic cell. (See. p. 98-99 in the textbook for help)

Part B: Temperature regulation strategies among animals

7. Among ectotherms and endotherms, which would rely more on **behavioral** changes to regulate their internal temperatures and why? Give an example of such behavioral changes in a specific organism.

8. You measure the metabolic rate (MR) of mice and snakes at both $5^{o}C$ ($41^{o}F$) and $25^{o}C$ ($77^{o}F$). Describe what the expected results would be in terms of which organism would have the higher MR at each temperature range and WHY.